

Effectiveness of App-based Positive Psychological Intervention on Patients Newly Diagnosed with Type 2
Diabetes
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Positive psychological constructs (PPCs), such as optimism, gratitude, self-efficacy, and resilience have been considered to positively impact adherence and self-care behaviour of patients with type 2 diabetes (T2DM) (Celano et al., 2013). Moreover, diabetes self-care behaviours would be consistently improved as the PPCs have strengthened (Huffman et al., 2015). Based on systematic reviews, the positive psychological intervention has significantly improved positive emotions, quality of life, self-efficacy, depression, optimism, gratitude, and well-being of patients with T2DM (Huffman et al., 2019; Steinhart et al., 2015; Miller et al., 2014, Cohn et al., 2014; DuBois et al., 2016; Moskowitz et al., 2017). The strengthen of PPCs could be regarded as a strategy for improving type 2 diabetes self-management.

Positive psychology intervention (PPI) emphasises enhancing PPCs via consciousness raising and enhancing personal strengths. With the systemic practice of PPI, it develops individual positive cognition and emotions. A previous Internet-based intervention study found that people have been taught positive emotional skills shown a significantly lower depression level than those having the daily emotional diary (Chon et al., 2014). Additionally, a one-group pre–post test study found that both optimism and gratitude have significantly increased after a 12-week phone-based PPI in patients with T2DM (Huffman et al., 2015). Another one-group pretest–posttest study demonstrated that optimism and well-being had significantly increased after a 12-week PPI. Furthermore, optimism, gratitude, frustrated, depressive, and distress, diabetes self-care and health behaviours adherence have obvious improved (DuBois et al., 2016). In recent study, Celano et al. (2019) demonstrated that self-care behaviour and diet behaviour had significantly improved after a 16-week phone-based psychological-motivational interviewing intervention among the patients with Type 2 diabetes (T2DM) with 8 years duration of diabetes.

Although previous studies have demonstrated the effectiveness of PPI on PPCs, only few studies investigate the impact on patients newly diagnosed with T2DM. The aim of this study is to explore the effectiveness of app-based PPI on patients newly diagnosed with T2DM.

Method

Design

This study will be conducted by experimental research design from 1st Oct 2021 to 31st July 2023. To prevent intervention contamination, patients newly diagnosed with T2DM of an endocrinology clinic in a medical center in northern Taiwan are assigned to the experimental group (n=57), while patients at an endocrinology clinic in southern Taiwan are assigned to the control group (n=113). Both groups have the pre-test at the baseline. Afterwards, experimental group will have a 3-month App-based intervention which include PPI and diabetes-related health education, physical records, and online consultation. The control

group only received a diabetes-related health education by certificated diabetes educators. The post-test will be conducted at the end of intervention, 3 months, and 9 months post- intervention.

Sampling

The inclusion criteria of eligible participants are: (1) newly diagnosed with T2DM less than 6 months; (2) aged 20 to 64; (3) without any mental illness; (4) controlling diabetes through oral medication or insulin injection; (5) able to use Android phone. Exclusion criteria were unable to communicate with language or having mental illness. Based on the previous literature, an a priori G*power was conducted to determine a sufficient sample size using an alpha value of 0.05, a power of 0.80, and medium effect size of 0.5 by t-test (DuBois et al., 2016; Miller et al., 2014; Steinhart et al., 2015). Ratio of numbers of participant in control group and experimental group will be 2:1. Moreover, an attrition rate of 20% was expected. Thus, the desired minimum sample size of 130 participants (experimental group= 57, control group= 113) are required for the study.

Outcome Measures

Outcome variables will be collected by self-reported questionnaires including followings.

1. Demographic and disease characteristics Form

Demographic and disease characteristics form is used to collect participants' gender, age, education level, marital status, occupation status, comorbidities (e.g., hyperlipidaemia, hypertension, and coronary artery disease), duration of diabetes, and treatment methods. Additionally, body mass index and HbA1c levels will be obtained from medical records of each participants.

2. Diabetes Distress Scale

Diabetes Distress Scale will assess the burden causing by diabetes self-management, which measured by a short form of Problem Areas in Diabetes scale in Chinese version (Hsu et al. 2013). It consists of 8 items, rated on a 4-point Likert scale, ranging from 0 (not a problem) to 4 (very serious problem). Total score ranges from 0 to 32, with high score indicating a greater level of diabetes distress.

3. Optimism

Optimism will be measured using the Life Orientation Test-Revised (LOT-R) developed by (Scheier et al., 1994). It consists of 6 items, rating from 0 as strongly disagree to 4 as strongly agree. The overall score of LOT-R is 42 points, with higher scores indicating higher dispositional level of optimism.

4. Gratitude

A Gratitude Questionnaire (GQ) is frequently used to assess in gratitude (McCullough et al., 2002). It consists of 6 items, rating from 1 (strongly disagree) to 7 (strongly agree). The overall score of GQ is 42 points, with higher scores indicating higher gratitude disposition.

5. Self-efficacy

A Diabetes Self-efficacy scale (DSES) is used to determine an individual's confidence on executing diabetes self-care behaviour (Lee et al., 2016). It consists of 14 items with a five-point Likert scale, rating from 0 as "Extremely unconfident" to 4 as "80% to 100% confident".

6. Diabetic Positive Characteristics Scale

A Diabetic Positive Characteristic Scale (DPCS) is used to determine individual positive characteristics of diabetic patients. It consists of 20 items with a five-point Likert scale, rating from 1 as "strongly disagree" to 5 as "strongly agree". The overall score of DPCS is 100 points, with higher scores indicating greater likelihood of positive characteristics disposition.

7. Self-care behaviour

A Diabetes Self-care Behaviour Scale-Chinese version is used to measure the level of self-care behaviour in diabetes patients (Lee et al., 2016). It consists of 17 items with five-point Likert scale, including exercise (3 items), dietary management (3 items), medical adherence (3 items), blood sugar monitoring (4 items), and adversity prevention (4 items). It rates from 0 (never) to 4 (always), ranging from 0 to 68 points. The higher scores indicate a greater execution in self-care behaviours.

8. Quality of life

A Quality of Life Scale (QoLS) is used to identify the impact of diabetes treatment in daily life (Hsu et al., 2018). It is a 15-item instrument with three sub-domains of Quality of life: psychosocial functioning, treatment regimen adherence, and diabetes-related influences in daily life. It consists of 15 items with five-point Likert scale (0= 'Never', 4= 'Always'), with higher scores indicating a higher quality of life.

App-based Intervention

The intervention will be conducted on the app, including PPI, diabetes-related health education, physical records, and online consultation. The PPI has included a 12-week PPI lessons (Table 1). Each lesson has separated into 3 parts: introduction, activity, and feedback. In term of Diabetes-related health education will include the basic knowledge of diabetes, diet, and exercise related videos. Physical records include their daily blood sugar, blood pressure, HbA1c, dietary record, and exercise record. In terms of dietary records, the amount of carbohydrates of each food will be calculate automatically after documented. Exercise records documents the burn of calories of each exercise (per 30 minutes). Both unit of dietary and exercise are based on Health Promotion Administration's criteria. Moreover, participants are available to have one-on-one instant online consultation with their diabetes educators via App.

Data Analysis

The statistical software IBM SPSS ver.25 will be used for data analysis. A χ^2 tests is used to compare the differences in demographic and disease characteristic between control group and experimental group. An independent t-test is used to compare the differences at baseline, week at the end of intervention, 3 months, and 9 months post-intervention for each outcome variable between control group and experimental group; and a paired t-test is used to compare the differences within both groups. A Generalized Estimation Equation

(GEE) is used to compare the changing amount of outcome variables from baseline to week at the end of intervention, to 3 months, and to 9 months post-intervention between a control group and experimental group. A p-value $<.05$ is considered statistically significant.

Table 1 Positive Psychological Interventions Outline

Week	Topic	Goal
Week1	Introduction of positive psychology	Understanding positive psychology
Week 1-1	Luxuries of Life	Intangible assets
Week 2	Plating the Seed of Hope	Promote motivation for change
Week 3	Learn to be Grateful	Enhance gratitude and optimism
Week 4	A little progress each day adds up a BIG result	Enhance confidence and keep motivation
Week 5	Exploring beauty	Enhance gratitude
Week 6	Show your talent	Reduce implementation difficulties and obstacles
Week 7	Encouragement: A Driving force for advancing	Enhance self-efficacy and resilience
Week 8	Thankful	Review the concepts of Gratitude
Week 9	Be Responsible to yourself	Enhance self-efficacy and resilience
Week 10	Be a better person	Enhance self-efficacy and resilience
Week 11	Have you found your beauty yet?	Review the concepts of beauty
Week 12	Do you have positive perspective of your life?	Evaluation and feedback

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